WHAT IS CLAIMED IS

1   1.   A GFP frame transfer apparatus for transferring a GFP
2   (Generic Frame Procedure) frame over a GFP network, comprising
3   an FCS generation section that generates, when said GFP frame
4   is generated and sent by said GFP frame transfer apparatus, an
5   FCS (Frame Check Sequence) using a payload field of said GFP
6   frame as a generation target area and adds this FCS to the FCS
7   field of said GFP frame.

1   2.   The GFP frame transfer apparatus according to claim 1,
2   further comprising an FCS check section that carries out, when
3   said GFP frame transfer apparatus receives said GFP frame, an
4   FCS check using said payload field and said FCS field of said
5   GFP frame.

1   3.   The GFP frame transfer apparatus according to claim 2,
2   wherein when said FCS check by said FCS check section detects
3   an error of the GFP frame to be transferred to the next GFP frame
4   transfer apparatus, said GFP frame is not discarded, but
5   transferred to the next GFP frame transfer apparatus with the
6   same FCS added when said error is detected.

1   4.   The GFP frame transfer apparatus according to claim 2,
2   further comprising a monitoring control processing section that
3   is notified, when said FCS check by said FCS check section detects
4   an error, of this error detection from said FCS check section
5   and notifies this error detection to the control system of said
6   GFP network.

1   5.   A GFP frame transfer apparatus for transferring a GFP

2   (Generic Frame Procedure) frame over a GFP network, comprising

3   an FCS recalculation section that recalculates, when said GFP

4   frame transfer apparatus receives said GFP frame and transfers

5   to the next GFP frame transfer apparatus, the FCS of said GFP

6   frame output from said GFP frame transfer apparatus based on

7   a difference of the extension header area of said GFP frame and

8   eHEC (extension Header Error Control) field before and after

9   an update in said GFP frame transfer apparatus and the FCS (Frame

10   Check Sequence) of said GFP frame when input to said GFP frame

11   transfer apparatus, and adds this FCS to the FCS field of said

12   GFP frame.

1   6.   The GFP frame transfer apparatus according to claim 5,

2   further comprising an FCS check section that carries out, when

3   said GFP frame transfer apparatus receives said GFP frame, an

4   FCS check using said payload area and said FCS field of said

5   GFP frame.

1   7.   The GFP frame transfer apparatus according to claim 6,

2   wherein when said FCS check by said FCS check section detects

3   an error of the GFP frame to be transferred to the next GFP frame

4   transfer apparatus, said GFP frame is not discarded, but

5   transferred to said next GFP frame transfer apparatus with said

6   FCS recalculated by said FCS recalculation section added.

1   8.   The GFP frame transfer apparatus according to claim 6,

2   further comprising a monitoring control processing section that

3   is notified, when said FCS check by said FCS check section detects

4   an error, of this error detection from said FCS check section

5   and notifies this error detection to the control system of said

6   GFP network.

1   9.   The GFP frame transfer apparatus according to claim 5,

2   wherein said FCS recalculation section comprises:

3   a subtraction circuit that calculates said difference of

4   said extension header area of said GFP frame and said eHEC field

5   before and after an update in said GFP frame transfer apparatus;

6   a CRC operation circuit that includes a plurality of

7   remainder registers, provides feedback corresponding to the

8   generating function G(x) of said FCS for said plurality of

9   remainder registers and receives said difference as input; and

10   an addition circuit that calculates a sum of the outputs

11   of said plurality of remainder registers of said CRC operation

12   circuit and the bits of said FCS of said GFP frame when input

13   to said GFP frame transfer apparatus.

1   10.   The GFP frame transfer apparatus according to claim 9,

2   wherein the FCS recalculation by said FCS recalculation section

3   is performed by calculating said difference by said subtraction

4   circuit, initializing all said plurality of remainder registers

5   of said CRC operation circuit to 0, inputting said difference

6   to said CRC operation circuit, inputting 0 by the number of bits

7   of said payload field+32 to said CRC operation circuit and adding

8   up the outputs of said plurality of remainder registers and said

9   bits of said FCS of said GFP frame when input to said GFP frame

10 transfer apparatus using said addition circuit at the next clock.

1   11. A GFP frame transfer apparatus for transferring a GFP

2   (Generic Frame Procedure) frame over a GFP network, comprising

3   an FCS check/error notification bit setting section that when

4   said GFP frame transfer apparatus receives said GFP frame,

5   carries out an error check using the FCS (Frame Check Sequence)

6   of said GFP frame, and when this FCS check detects an error,

7   sets an error notification bit in a predetermined field in the

8   extension header area of said GFP frame.

1   12. The GFP frame transfer apparatus according to claim 11,

2   wherein when said FCS check by said FCS check/error notification

3   bit setting section detects an error of the GFP frame to be

4   transferred to the next GFP frame transfer apparatus, said GFP

5   frame is not discarded, but transferred to the next GFP frame

6   transfer apparatus with the FCS recalculated by said GFP frame

7   transfer apparatus added.

1   13. The GFP frame transfer apparatus according to claim 11,

2   wherein said GFP frame is a GFP ring frame and said predetermined

3   field in which said error notification bit is set is provided

4   in part of the Spare field in said extension header area of said

5   GFP ring frame.

1   14.   The GFP frame transfer apparatus according to claim 1,

2   wherein said GFP frame is a GFP ring frame.

1   15.   The GFP frame transfer apparatus according to claim 1,

2   wherein said GFP frame is a GFP path frame that stores a label

3   corresponding to a path ID defined to uniquely specify the path

4   from the Ingress node to Egress node in said GFP network in a

5   predetermined field of the extension header area.

1   16.   The GFP frame transfer apparatus according to claim 1,

2   further comprising a packet extraction section that terminates

3   the frame of the subnetwork that stores a packet to be stored

4   in the payload field of said GFP frame and extracts said packet

5   from the frame of said subnetwork.

1   17.   The GFP frame transfer apparatus according to claim 16,

2   wherein said packet extraction section extracts said packet by

3   removing unnecessary overhead for said subnetwork from the frame

4   of said subnetwork.

1   18.   The GFP frame transfer apparatus according to claim 16,

2   wherein said subnetwork is Ethernet.

1   19.   The GFP frame transfer apparatus according to claim 18,

2   wherein said packet extraction section extracts said packet from

3   the payload of the Ethernet frame of said Ethernet.

1   20.   The GFP frame transfer apparatus according to claim 16 or

2   claim 17, wherein said subnetwork is a POS (Packet Over SONET).

1   21.   The GFP frame transfer apparatus according to claim 20,

2   wherein said packet extraction section extracts said packet from

3   the payload of the HDLC frame of said POS.

1   22.   The GFP frame transfer apparatus according to claim 1,

2   further comprising a GFP frame transmission section that stores

3   said GFP frame in a layer 1 frame which is the first layer frame

4   of an OSI reference model accommodating said GFP frame in said

5   GFP network and sends said layer 1 frame storing said GFP frame

6   from an appropriate output port of said GFP frame transfer

7   apparatus to said GFP network.

1   23.   The GFP frame transfer apparatus according to claim 22,

2   wherein a SONET (Synchronous Optical NETwork) is used as the

3   first layer of said OSI reference model.

1   24.   The GFP frame transfer apparatus according to claim 23,

2   wherein said GFP frame transmission section stores said GFP frame

3   in the payload of the SONET frame of said SONET and sends said

4   SONET frame storing said GFP frame to said GFP network.

1   25.   The GFP frame transfer apparatus according to claim 22,

2   wherein an OTN (Optical Transport Network) is used as the first

3   layer of said OSI reference model.

1   26. The GFP frame transfer apparatus according to claim 25,

2   wherein said GFP frame transmission section stores said GFP frame

3   in an OPUk (Optical channel payload unit) which is the payload

4   of the digital wrapper frame of said OTN and sends said digital

5   wrapper frame that stores said GFP frame to said GFP network.

1   27. A GFP frame transfer method for transferring a GFP (Generic

2   Frame Procedure) frame over a GFP network, comprising an FCS

3   generating step of generating, when said GFP frame is generated

4   and sent by said GFP frame transfer apparatus, an FCS (Frame

5   Check Sequence) using a payload field of said GFP frame as a

6   generation target area and adding this FCS to the FCS field of

7   said GFP frame.

1   28. The GFP frame transfer method according to claim 27, further

2   comprising an FCS checking step of carrying out, when said GFP

3   frame transfer apparatus receives said GFP frame, an FCS check

4   using said payload field and said FCS field of said GFP frame.

1   29. The GFP frame transfer method according to claim 28, wherein

2   when said FCS check in said FCS checking step detects an error

3   of the GFP frame to be transferred to the next GFP frame transfer

4   apparatus, said GFP frame is not discarded, but transferred to

5   the next GFP frame transfer apparatus with the same FCS added

6   when said error is detected.

1   30. The GFP frame transfer method according to claim 28, further

2   comprising a monitoring control processing step of notifying,

3   when said FCS check in said FCS checking step detects an error,

4   of this error detection to the control system of said GFP network.

1   31. A GFP frame transfer method with a GFP frame transfer

2   apparatus for transferring a GFP (Generic Frame Procedure) frame

3   over a GFP network, comprising an FCS recalculating step of

4   recalculating, when said GFP frame transfer apparatus receives

5   said GFP frame and transfers to the next GFP frame transfer

6   apparatus, the FCS of said GFP frame output from said GFP frame

7   transfer apparatus based on a difference of the extension header

8   area of said GFP frame and eHEC (extension Header Error Control)

9   field before and after an update in said GFP frame transfer

10 apparatus and the FCS (Frame Check Sequence) of said GFP frame

11 when input to said GFP frame transfer apparatus, and adding this

12 FCS to the FCS field of said GFP frame.

1   32. The GFP frame transfer method according to claim 31, further

2   comprising an FCS checking step of carrying out, when said GFP

3   frame transfer apparatus receives said GFP frame, an FCS check

4   using said payload area and said FCS field of said GFP frame.

1   33. The GFP frame transfer method according to claim 32, wherein

2   when said FCS check in said FCS checking step detects an error

3   of the GFP frame to be transferred to the next GFP frame transfer

4   apparatus, said GFP frame is not discarded, but transferred to

5   said next GFP frame transfer apparatus with said FCS recalculated

6   in said FCS recalculating step added.

1   34.   The GFP frame transfer method according to claim 32, further

2   comprising a monitoring control processing step of notifying,

3   when said FCS check in said FCS checking step detects an error,

4   this error detection to the control system of said GFP network.

1   35.   The GFP frame transfer method according to claim 31, wherein

2   said FCS recalculating step comprises:

3   a subtraction circuit that calculate said difference of

4   said extension header area of said GFP frame and said eHEC field

5   before and after an update in said GFP frame transfer apparatus;

6   a CRC operation circuit that includes a plurality of

7   remainder registers, provides feedback corresponding to the

8   generating function G(x) of said FCS for said plurality of

9   remainder registers and receives said difference as input; and

10   an addition circuit that calculates a sum of the outputs

11 of said plurality of remainder registers of said CRC operation

12 circuit and the bits of said FCS of said GFP frame when input

13 to said GFP frame transfer apparatus.

1   36.   The GFP frame transfer method according to claim 35, wherein

2   the FCS recalculation in said FCS recalculating step is performed

3   by calculating said difference by said subtraction circuit,

4   initializing all said plurality of remainder registers of said

5   CRC operation circuit to 0, inputting said difference to said

6   CRC operation circuit, inputting 0 by the number of bits of said

7   payload field+32 to said CRC operation circuit and adding up

8   said outputs of said plurality of remainder registers and said

9   bits of said FCS of said GFP frame when input to said GFP frame

10   transfer apparatus using said addition circuit at the next clock.

1   37. A GFP frame transfer method with a GFP frame transfer

2   apparatus for transferring a GFP (Generic Frame Procedure) frame

3   over a GFP network, comprising an FCS check/error notification

4   bit setting step of carrying out, when said GFP frame transfer

5   apparatus receives said GFP frame, an error check using the FCS

6   (Frame Check Sequence) of said GFP frame, and when this FCS check

7   detects an error, setting an error notification bit in a

8   predetermined field in the extension header area of said GFP

9   frame.

1   38. The GFP frame transfer method according to claim 37, wherein

2   when said FCS check in said FCS check/error notification bit

3   setting step detects an error of the GFP frame to be transferred

4   to the next GFP frame transfer apparatus, said GFP frame is not

5   discarded, but transferred to the next GFP frame transfer

6   apparatus with the FCS recalculated by said GFP frame transfer

7   apparatus added.

1   39. The GFP frame transfer method according to claim 37, wherein

2   said GFP frame is a GFP ring frame and said predetermined field

3   in which said error notification bit is set is provided in part

4   of the Spare field in said extension header area of said GFP

5   ring frame.

1   40.   The GFP frame transfer method according to claim 27, wherein
2   said GFP frame is a GFP ring frame.

1   41.   The GFP frame transfer method according to claim 27, wherein
2   said GFP frame is a GFP path frame that stores a label corresponding
3   to a path ID defined to uniquely specify the path from the Ingress
4   node to Egress node in said GFP network in a predetermined field
5   in the extension header area.

1   42.   The GFP frame transfer method according to claim 27, further
2   comprising a packet extracting step of terminating the frame
3   of the subnetwork that stores a packet to be stored in the payload
4   field of said GFP frame and extracting said packet from the frame
5   of said subnetwork.

1   43.   The GFP frame transfer method according to claim 42, wherein
2   in said packet extracting step, said packet is extracted by
3   removing unnecessary overhead for said subnetwork from the frame
4   of said subnetwork.

1   44.   The GFP frame transfer method according to claim 42, wherein
2   said subnetwork is Ethernet.

1   45.   The GFP frame transfer method according to claim 44, wherein
2   in the packet extracting step, said packet is extracted from
3   the payload of the Ethernet frame of said Ethernet.

1   46.   The GFP frame transfer method according to claim 42, wherein

2   said subnetwork is a POS (Packet Over SONET).

1   47.   The GFP frame transfer method according to claim 46, wherein

2   in said packet extracting step, said packet is extracted from

3   the payload of the HDLC frame of said POS.

1   48.   The GFP frame transfer method according to claim 27, further

2   comprising a GFP frame transmitting step of storing said GFP

3   frame in a layer 1 frame which is the first layer frame of an

4   OSI reference model accommodating said GFP frame in said GFP

5   network and sending said layer 1 frame storing said GFP frame

6   from an appropriate output port of said GFP frame transfer

7   apparatus to said GFP network.

1   49.   The GFP frame transfer method according to claim 48, wherein

2   a SONET (Synchronous Optical NETwork) is used as the first layer

3   of said OSI reference model.

1   50.   The GFP frame transfer method according to claim 49, wherein

2   in said GFP frame transmitting step, said GFP frame is stored

3   in the payload of the SONET frame of said SONET and said SONET

4   frame storing said GFP frame is sent to said GFP network.

1   51.   The GFP frame transfer method according to claim 48, wherein

2   an OTN (Optical Transport Network) is used as the first layer

3   of said OSI reference model.

1   52.   The GFP frame transfer method according to claim 51, wherein

2   in said GFP frame transmitting step, said GFP frame is stored

3   in an OPUk (Optical channel payload unit) which is the payload

4   of the digital wrapper frame of said OTN and said digital wrapper

5   frame that stores said GFP frame is sent to said GFP network.